

Q1. Answer: c) Band-to-band radiative recombination

- In LEDs, electrons recombine with holes across the bandgap, releasing photons (light). Competing mechanisms like SRH and Auger reduce efficiency.

Q2. Answer: c) Generation = Recombination

- In thermal equilibrium, generation and recombination balance exactly. This ensures that carrier concentrations remain constant.

Q3. Answer: b) High-level injection and heavily doped semiconductors

- Auger recombination becomes significant when carrier concentrations are very high, such as in highly doped regions or under strong injection (e.g., LEDs, lasers).

Q4. Answer: c) $U = \Delta n / \tau$

In low-level injection, recombination is proportional to the excess carrier concentration Δn with time constant τ (the carrier lifetime).

Q5. Answer: b) Trap-assisted recombination at defects and surfaces

- Defect-related SRH recombination reduces carrier lifetime and lowers the photocurrent. Good surface passivation and material quality help maximize efficiency.